

המחלקה למתמטיקה

סמסטר 22-2021-א

שם הקורס אלגברה הומוטופית

מספר קורס 201.2.2091

עמוד הקורס ברשת

https://www.math.bgu.ac.il/~amyekut/teaching/2021-22/homol-alg/course_page.html

מרצה אחראי פרופ' אמנון יקותיאלי, <amyekut@bgu.ac.il>, חדר 202

שעות קבלה <https://www.math.bgu.ac.il/he/teaching/hours>

תקציר

permits) time as much (as Topics: Course

1. noncommutative (including modules and ideals rings, On material. prior of Review rings).

2. be will topic (This categories. linear on Emphasis functors. and Categories along.) go we as gradually, introduced

3. polynomial sums, direct products, modules, Free constructions. Universal rings.

4. properties. and construction Definition, products. Tensor

5. functors. and sequences Exact Exactness.

6. modules. flat and injective Projective, modules. Special

7. long the homotopies, complexes, on Operations modules. of Complexes sequence. cohomology exact

8. resolutions. injective and flat Projective, Resolutions.

9. algebra. commutative to Applications functors. derived right and Left

10. extensions. problems, Classification functors. derived of applications Further

11. Theory. Morita



”Commutative course subsequent the to move might material the of (Some Algebra“)

¹page web course the see requirements course and syllabus updated an For

²דרישות והרכב ציון הקורס

³page web course see

¹https://www.math.bgu.ac.il/~amyekut/teaching/2021-22/homol-alg/course_page.html

²דרישות הקורס יכולות להשתנות במהלך השבועיים הראשונים של הסמסטר, ויש לשים לב להודעות באתר הקורס

³https://www.math.bgu.ac.il/~amyekut/teaching/2021-22/homol-alg/course_page.html

syllabus – new plan

7 June 2021

Amnon Yekutieli

Homological Algebra

Fall Semester 2021-22

Catalog Number: 201.2.2091

Prerequisites:

1. Algebraic Structures
2. Introduction to Topology

Recommended:

1. Introduction to Commutative Algebra
2. Introduction to Algebraic Geometry
3. Basic Concepts in Topology and Geometry

Course Topics: (as much as time permits)

1. **Review of prior material.** On rings, ideals and modules (including noncommutative rings).
2. **Categories and functors.** Emphasis on linear categories. (This topic will be introduced gradually, as we go along.)
3. **Universal constructions.** Free modules, products, direct sums, polynomial rings.
4. **Tensor products.** Definition, construction and properties.
5. **Exactness.** Exact sequences and functors.
6. **Special modules.** Projective, injective and flat modules.
7. **Complexes of modules.** Operations on complexes, homotopies, the long exact cohomology sequence.
8. **Resolutions.** Projective, flat and injective resolutions.
9. **Left and right derived functors.** Applications to commutative algebra.
10. **Further applications of derived functors.** Classification problems, extensions.
11. **Morita Theory.**

(Some of the material might move to the subsequent course "Commutative Algebra")

נושאי לימוד

- .1 (including Rings material. prior Recalling modules ideals, noncommutative), tensor products, and sums direct infinite sequences, exact bimodules, and rings. and modules of products
- .2 categories Linear equivalences. functors, of Morphisms functors. and Categories functors. of Exactness functors. linear and
- .3 modules. flat and injective Projective, modules. Special
- .4 products. tensor as realized categories module of Equivalences Theory. Morita
- .5 long the homotopies, complexes, on Operations modules. of Complexes sequence. cohomology exact
- .6 uniqueness. and existence – resolutions flat and injective Projective, Resolutions.
- .7 functors. Ext and Tor theory. general The functors. derived right and Left
- .8 involving theorems, global and local Some algebra. commutative to Applications functors. torsion and completion Derived functors. *Ext* and *Tor*
- .9 geometry. in algebra homological of role the of survey A cohomology. Sheaf
- .10 cohomology, Galois theorems: classification of survey A cohomology. Nonabelian bundles. vector

Bibliography

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⁴<http://stacks.math.columbia.edu>

⁵<https://arxiv.org/abs/1610.09640v4>